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(54) Making fibreboard

(57) For the manufacture of fibreboard, there is used an apparatus provided with an endless conveyor belt (1) made of a permeable material, to a portion of which belt suction is applied by a suction box (3). A slurry of fibre from a supply tank (7) flows down a flow passage (5) in contact with the belt whilst the latter moves in the direction shown by the arrows, whereby a layer of fibre (A) is deposited upon the portion of the belt to which suction is applied. This layer of fibre is dried by an air blowing device (13) and by an air suction device (14). It is then removed from the belt and used to form fibreboard.

FIG.1

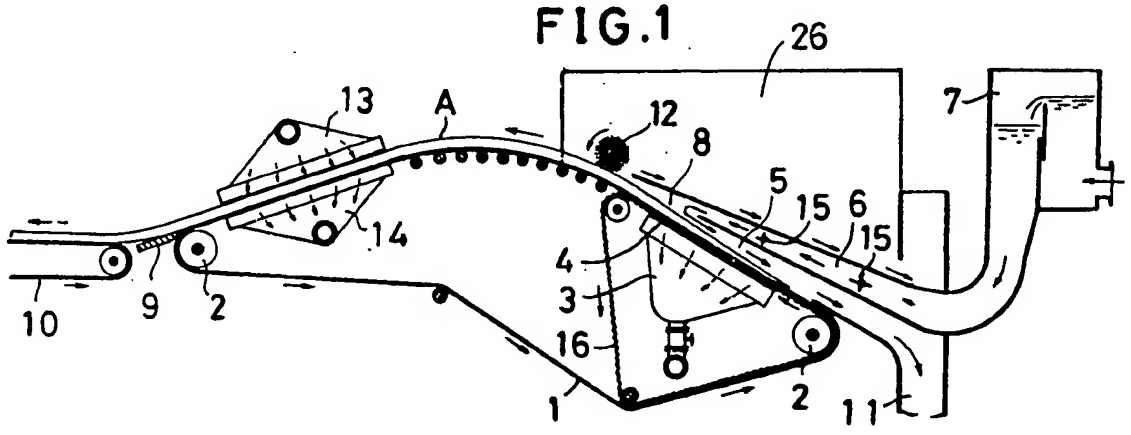

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FIG.1

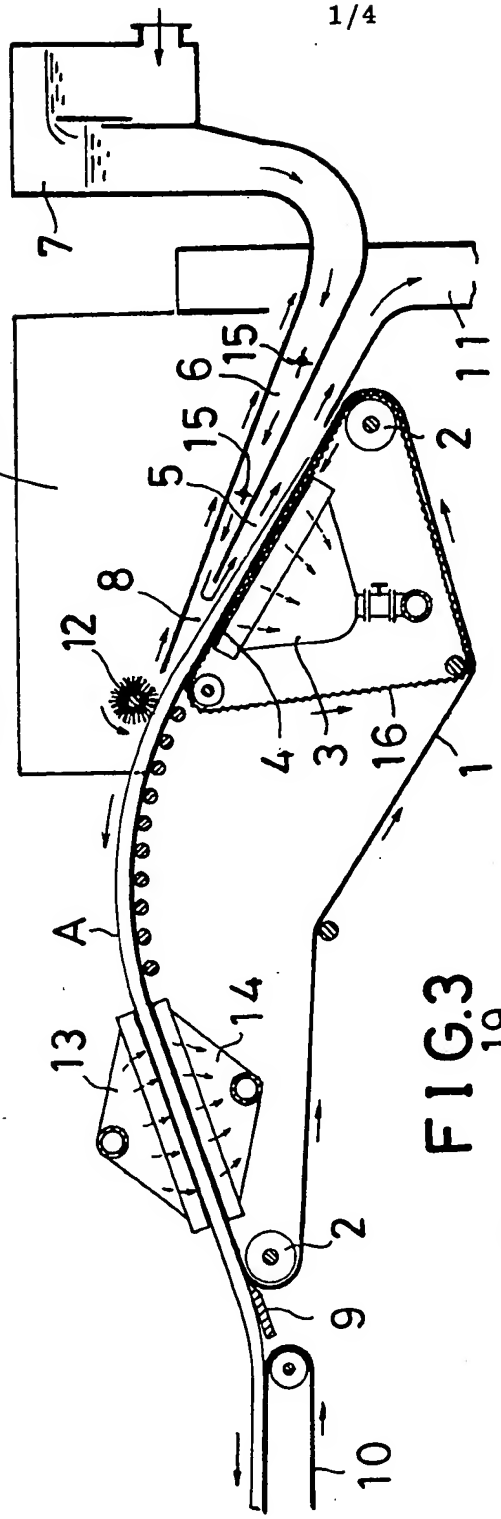


FIG.3

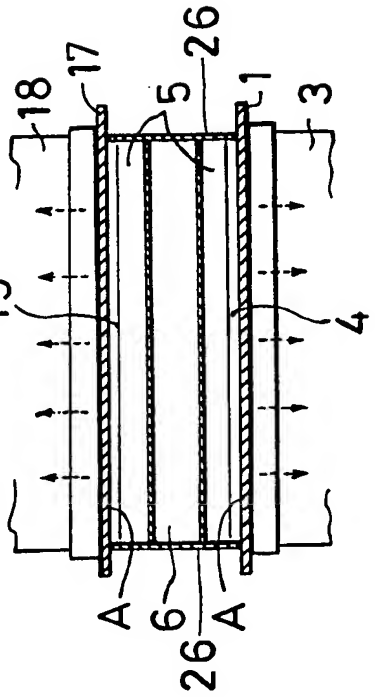


FIG.2

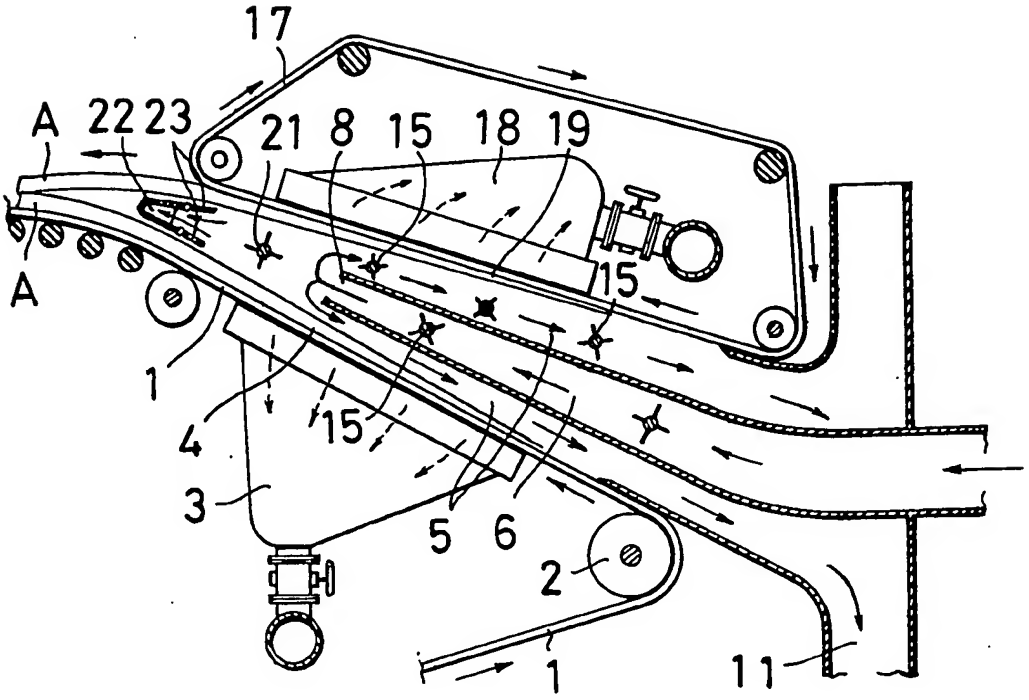

17
A
22
23
21
8
15
18
19
A
15
1
4
15
3
5
6
2
1
11

FIG.4

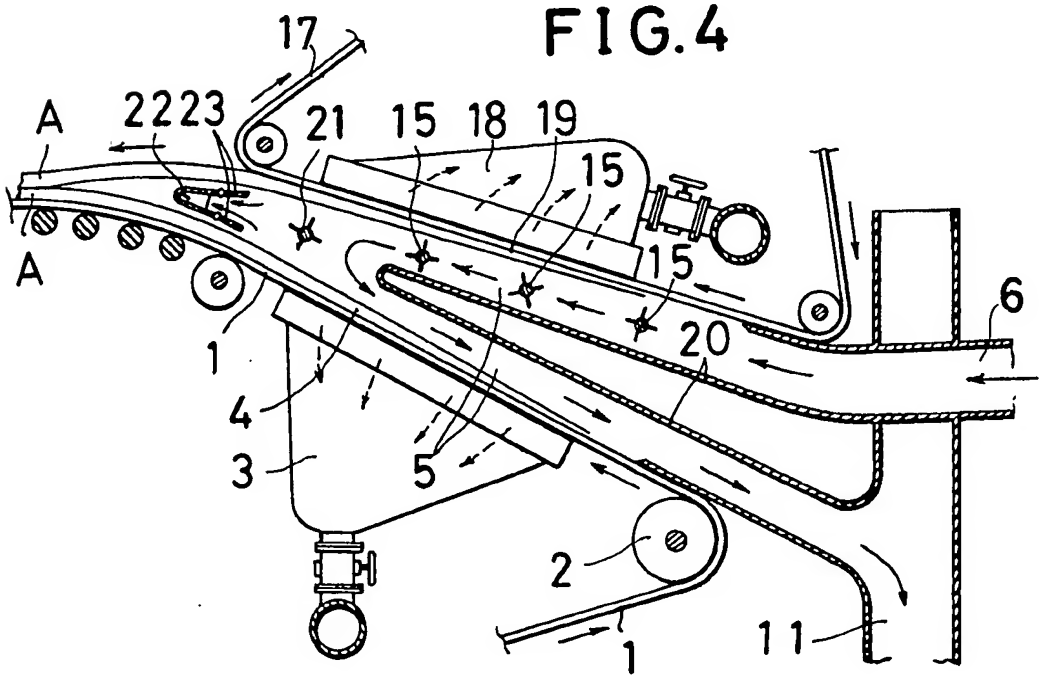

17
A
22
23
21
15
18
19
15
A
15
6
1
20
4
3
5
2
1
11

FIG.5

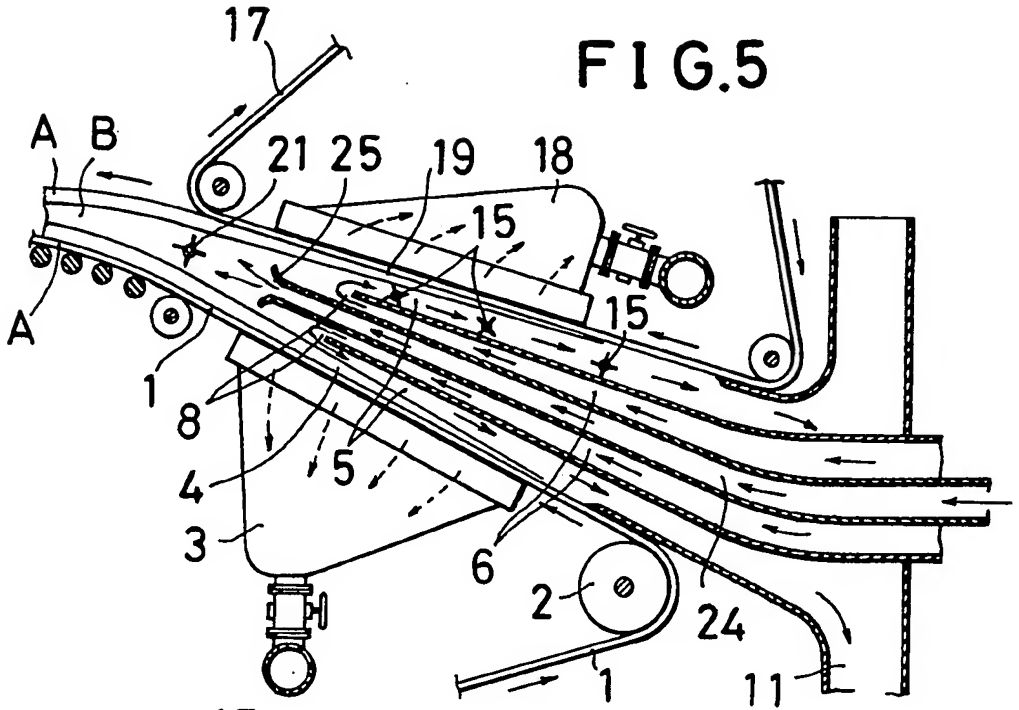

17
A
B
21
25
19
18
15
15
A
1
8
4
5
3
6
2
24
1
11

FIG.6

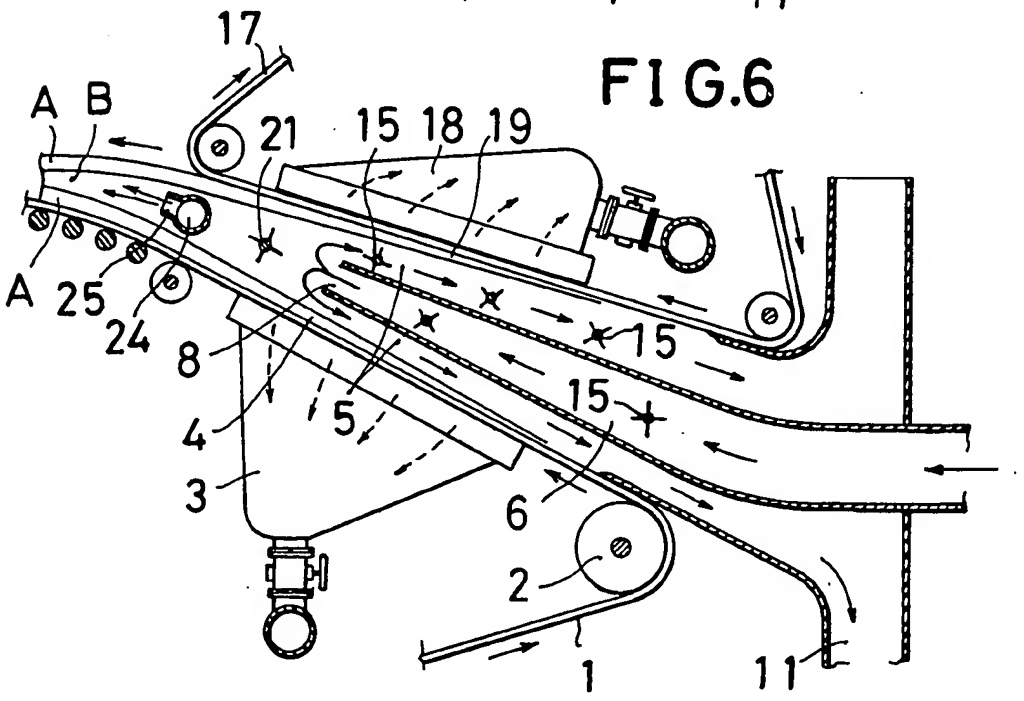

17
A
B
21
15
18
19
A
25
24
8
4
5
3
15
15
6
2
1
11

FIG. 7

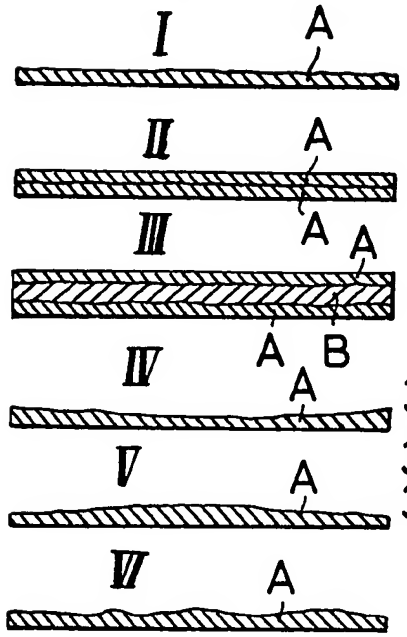


FIG. 8

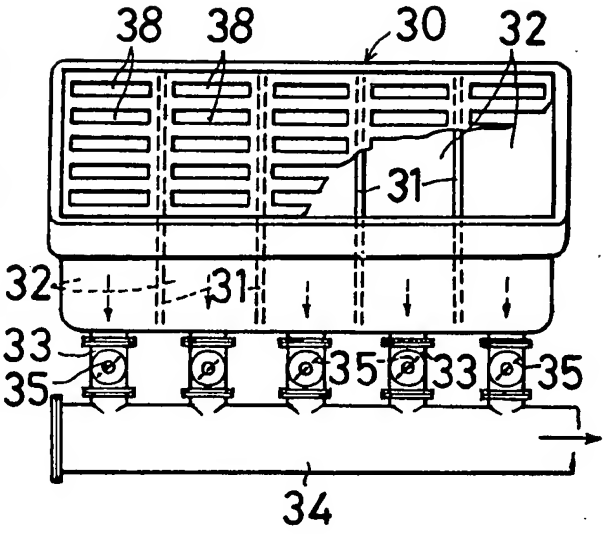


FIG. 9

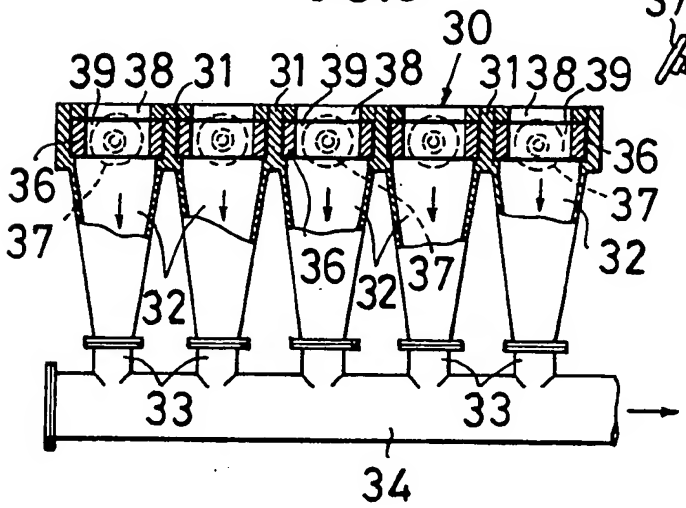
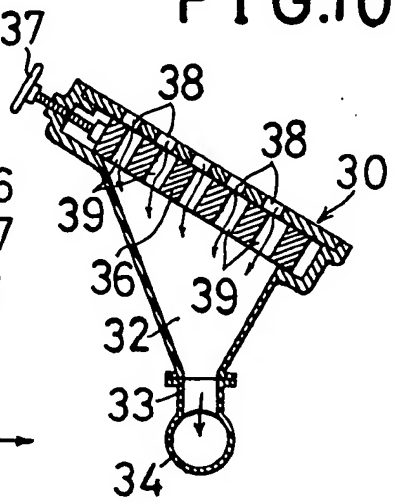


FIG. 10



SPECIFICATION

Manufacture of fibreboard

This invention relates to the manufacture of fibreboard.

According to the invention, there is provided an apparatus for the manufacture of fibreboard, comprising (a) an endless conveyor belt made of a permeable material, (b) suction means provided on one side of a portion of the belt for applying suction to this portion of the belt, and (c) a flow passage provided on the other side of said portion of the belt; whereby, in use of the apparatus, the belt is moved whilst a slurry of fibre is caused to flow through the flow passage and whilst suction is applied to said portion of the belt by the suction means, a layer of fibre for forming the required fibreboard thereby deposited upon the belt.

The invention also provides an apparatus for the manufacture of fibreboard, comprising (a) a first endless conveyor belt made of a permeable material, (b) first suction means provided below a portion of the first belt for applying suction to this portion of the first belt, (c) a second endless conveyor belt made of a permeable material, (d) second suction means provided above a portion of the second belt for applying suction to this portion of the second belt, and (e) a flow passage provided between said portions of the first and second belts; whereby, in use of the apparatus, the first and second belts are moved in opposite directions whilst a slurry of fibre is caused to flow through the flow passage and whilst suction is applied to said portions of the first and second belts by the respective suction means, layers of fibre forming the required fibreboard thereby being deposited upon each of the first and second belts.

The invention further provides a method for the manufacture of fibreboard, which comprises causing a slurry of fibre to contact one side of a portion of a moving endless conveyor belt whilst suction is applied to the other side of said portion of the belt, a layer of fibre for forming the required fibreboard thereby being deposited upon the belt.

For a better understanding of the invention, reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is a sectional view of an apparatus of the invention;

Figure 2 is an enlarged sectional view of a portion of a modification of the apparatus of Fig. 1;

Figure 3 is a cross-sectional view of the apparatus of Fig. 2;

Figures 4, 5 and 6 are enlarged sectional views of a portion of modifications of the apparatus of Fig. 1;

Figures 7I and 7VI are cross-sectional views of fibreboards obtained by use of the apparatus of Figs. 1 to 6;

Figure 8 is a partial sectional view of a suction box for use in the apparatus of Figs. 1 to 6;

Figure 9 is a sectional view of another suction box for use in the apparatus of Figs. 1 to 6; and

Figure 10 is a longitudinal sectional view of the suction box of Fig. 9.

Referring to Fig. 1, an endless conveyor belt 1 passes around guide rolls 2 and is to be driven in the direction shown by the arrows. The belt is permeable to air and water and is, for example, a wire net or a fibrous material such as felt. A portion of the belt forms an inclined surface above a suction box 3. A flow passage 5 for a slurry of fibre extends above the inclined portion of the belt 1. The passage 5 is defined by lateral walls 26 on both sides thereof, and is connected via a supply opening 8 and a supply duct 6 to a header tank 7. Accordingly, the slurry flowing through the supply opening 8 flows down the flow passage 5, and the flow direction thereof is opposite to the direction of movement of the conveyor belt 1. This means that the fibres flow at a speed different from the speed of the conveyor belt 1. During this flow, the water of the slurry is removed by the suction generated by the suction box 3, and consequently the fibres are held on the conveyor belt 1 to form a layer 4 of fibre.

This layer is conveyed forward, and is thereafter removed from the conveyor belt 1 a stripping member 9 and is transferred onto a delivery belt 10. Thereafter, the layer is subjected to any necessary subsequent steps such as cutting, pressing (with or without heating), and drying. Thus, fibreboard is produced.

The remainder of the slurry flowing down the flow passage 5 passes into a discharge tube 11 for recovery. Any slurry flowing forward from the supply opening 8 is turned back towards the discharge tube 11 by the action of a brush roller 12. The recovered slurry is returned to the tank 7 for reuse.

An air blowing chamber 13 and an air suction chamber 14 are disposed on opposite sides of the belt. These serve to remove water from the fibre layer. A stirrer 15, such as a roller with fins or the like, is disposed in the supply tube 6 to prevent the fibres in the slurry from precipitating and to prevent the distribution of the fibres in the slurry from becoming non-uniform.

When a sheet of fibrous material such as felt is used as the conveyor belt 1, a belt 16 of air-permeable material such as wire net is interposed between the belt 1 and the suction box 3. This belt 16 runs with belt 1, and prevents frictional wear of the belt 1.

The fibres in the slurry are dispersed freely at random with respect to their direction, but in the course of their flow down the flow passage 5, the fibres are arranged along the

flow direction. Additionally, when the flowing fibres are attracted at one end by the suction generated by the suction box 3 to the surface of the conveyor belt 1 or to the surface of the fibre layer previously formed, the fibres are deposited lengthwise due to the difference in speed between the conveyor belt 1 and the fibres. Consequently, almost all of the fibres are arranged in the direction of movement of the conveyor belt 1, so that there results fibreboard which is extremely resistant to bending forcees and tensile forces. In addition, the surface which has been in contact with belt 1 has an attractive appearance, due to the ordered arrangement of the fibres. Thus, there can be produced fibreboard that is suitable as wall boards for building or the like.

In addition, due to the inclination of the belt 1 and of the inclination of the passage 5, no power is required for supplying the slurry, and the slurry can be supplied at a speed different from the speed of the conveyor belt 1, and thus the apparatus can be simplified.

The slurry may be any conventional slurry such as a slurry of vegetable, mineral or sythetic fibres. For instance, it may consist of the fibres alone dispersed in water. The slurry may additionally contain an adhesive such as cement, powdered plaster or a thermosetting sythetic resin. Examples of suitable slurries are a slurry of 2% by weight of wood pulp fibre and 98% by weight of water, and slurries of 7 to 15% by weight of one or more fibres such as wood pulp, glass fibres, rock wool and synthetic fibres and 93 to 85% by weight of water. If desired, inorganic or mineral powders may be present in the slurries as filling agents.

Fig. 2 shows a modification of Fig. 1, for making fibreboard of greater thickness. There is additionally provided, above the belt 1, another endless conveyor belt 17 and another suction box 18 for forming another layer 19 of fibres. The two layers 4 and 19 are joined at A to form fibreboard of increased thickness. Additionally, the supply duct 6 extends along the centre of the passage 5, and consequently the slurry flowing out of the supply opening 8 is diverted both upwards and downwards so as to flow along the respective belts 17 and 1.

Alternatively, the arrangement for supplying the slurry can be modified as shown in Fig. 4. Namely, a partition wall 20 for dividing the flow passage 5 into upper and lower portions is disposed in the flow passage 5, and the upper portion is connected to the supply duct 6. Thus, the slurry is supplied upwards to the upper portion of the passage from the lower end thereof and thereafter flows down the lower portion thereof. In this case, the flow speed of the slurry in the upper portion differs from the speed of movement of belt 17.

Referring to Figs. 2 and 4, a ravelling means 21 comprising a roller with fins is provided in flow passage 5, and serves to prevent the fibres from entangling together into a lump and mixing with layers 4 and 19. A suction chamber 22 having an opening 23 is provided transversely across the width of the flow passage 5, so that the slurry is forced to flow outwards towards the belts 1 and 17. Thus, the amounts of slurry in the vicinity of the belts 1 and 17, and thus the thickness of the layers 4 and 19, can be controlled. In addition, chamber 22 prevents a layer of randomly-distributed fibres from being formed between layers 4 and 19, which layer of randomly-distributed fibres would reduce the bending strength of the fibreboard.

Figs. 5 and 6 each show a modification of Fig. 1, for making fibreboard of much larger thickness. In each case, separately from the supply line 6 for the slurry, another supply line for supplying a slurry of the same of different kind is provided so that an intermediate layer may be formed between the upper and lower layers 4 and 19. In the embodiment shown in Fig. 5, a subsidiary supply duct 24 is disposed in the supply duct 6, and the front opening 25 thereof is positioned upstream of the supply opening 8 of the supply duct 6. In the embodiment shown in Fig. 6, a subsidiary supply duct 24 with a forward-facing opening 25 is provided between the upper and lower layers and at the upstream end of the flow passage 5. Thus, by supplying a slurry through the subsidiary supply duct 24, an intermediate fibre layer of predetermined thickness is formed between the upper and lower fibre layers, and accordingly a sheet of fibreboard of especially large thickness can be obtained. If an economical raw material is used for forming the intermediate layer, fibreboard of very large thickness can be obtained economically. For this purpose, fibres cheaper than the fibres used for the fibre layers 4 and 19, and/or fibres of inorganic or organic powders, may be used. If an adhesive agent such as cement is present in the slurry for the intermediate layer, the intermediate layer serves to strengthen bonding between the upper and lower layers 19 and 4 and additionally serves to increase the strength of the fibreboard as a whole.

Fig. 7 shows cross sectional views of the fibreboards produced. Fig. 7I shows a fibreboard consisting of a single fibre layer A, produced by the use of the apparatus shown in Fig. 1. Fig. 7II shows a fibreboard consisting of joined upper and lower layers A, produced by use of the apparatus shown in Fig. 2 or 4. Fig. 7III shows a fibreboard consisting of an intermediate layer B joined to upper and lower layers A, produced by use of the apparatus shown in Fig. 5 or 6.

As shown in these cross sectional views, it is preferred that the fibreboard have a substantially uniform thickness. However, the thickness of the fibreboard is often non-uni-

form, due to variations in the suction force applied during manufacture as a result of clogging and to variations in the permeability of the belt. In this case, fibreboards such as shown in Figs. 7IV, 7V and 7VI are obtained.

For correcting such unequality of thickness, the suction force of the suction box may be adjusted at individual portions transverse to the direction of movement of the fibre layer, so as to adjust the fibre layer thickness so that it becomes uniform.

One example of such an adjusting means is shown in Fig. 8. The interior of the suction box 30 is divided by partition walls 31 into a plurality of suction chambers 32 disposed transverse to the direction of movement of the fibre layer. The chambers 32 are in communication with one another via a suction tube 34 and respective connecting tubes 33. Each connecting tube 33 is provided with an adjusting valve 35, so that by adjusting these valves 35 the distribution of the suction force at the front of the suction box 30 can be adjusted across the width thereof.

Figs. 9 and 10 show another device for adjusting the suction force. The interior of the suction box 30 is divided by partition walls 31 into a plurality of suction chambers 32 disposed across the width thereof, and each suction chamber 32 is connected via a connecting tube 33 to a suction tube 34. A perforation plate 36 is provided in each suction chamber 32. These plates are slidable by operation of screw 37, so that the degree of overlap of openings 38 with openings 39 and therefore the suction force of each suction chamber 32, can be varied.

By using a suction box having the foregoing means for adjusting the suction force, the thickness of the fibre layer can be corrected across its width and there can be obtained a layer which is uniform in thickness.

CLAIMS

1. An apparatus for the manufacture of fibreboard, comprising (a) an endless conveyor belt made of a permeable material, (b) suction means provided on one side of a portion of the belt for applying suction to this portion of the belt, and (c) a flow passage provided on the other side of said portion of the belt; whereby, in use of the apparatus, the belt is moved whilst a slurry of fibre is caused to flow through the flow passage and whilst suction is applied to said portion of the belt by the suction means, a layer of fibre for forming the required fibreboard thereby being deposited upon the belt.

2. An apparatus according to claim 1, wherein said portion of the belt is inclined relative to the horizontal.

3. An apparatus for the manufacture of fibreboard, comprising (a) a first endless conveyor belt made of a permeable material, (b) first suction means provided below a portion of the first belt for applying suction to this portion of the first belt, (c) a second endless conveyor belt made of a permeable material, (d) second suction means provided above a portion of the second belt for applying suction to this portion of the second belt, and (e) a flow passage provided between said portions of the first and second belts; whereby in use of the apparatus, the first and second belts are moved in opposite directions whilst a slurry of fibre is caused to flow through the flow passage and whilst suction is applied to said portions of the first and second belts by the respective suction means, layers of fibre for forming the required fibreboard thereby being deposited upon each of the first and second belts.

4. An apparatus according to claim 3, wherein said portions of the first and second belts are inclined relative to the horozontal.

5. An apparatus according to claim 3 or 4, wherein a means for the supply of a slurry of fibre is disposed between the first and second belts, whereby, in use of the apparatus, an intermediate layer of fibre can be formed between the layers of fibre deposited upon the first and second belts.

6. An apparatus according to any of claims 1 to 5, wherein the or each suction means is divided by partition walls into a plurality of chambers extending across the width of the respective belt, and wherein means are provided for adjusting the suction force applied to each chamber.

7. An apparatus for the manufacture of fibreboard, substantially as hereinbefore described with reference to, and as shown in, Fig. 1, or Fig. 1 as modified by Figs. 2 and 3, or Fig. 1 as modified by any of Figs. 4, 5 and 6.

8. An apparatus according to claim 7, wherein the or each suction means thereof is a suction means substantially as hereinbefore described with reference to, and as shown in, Fig. 8 or Figs. 9 and 10.

9. A method for the manufacture of fibreboard, which comprises causing a slurry of fibre to contact one side of a portion of a moving endless conveyor belt whilst suction is applied to the other side of said portion of the belt, a layer of fibre for forming the required fibreboard thereby being deposited upon the belt.

10. A method according to claim 9, wherein said portion of the belt is inclined relative to the horizontal, wherein the belt is moved in a direction such that said inclined portion thereof moves in an upward direction, and wherein the slurry is caused to flow in contact with said inclined portion of the belt in a downward direction.

11. A method according to claim 9 or 10, wherein the slurry contains (a) cement, powdered plaster, thermosetting resin or other adhesive, and/or (b) a powdered filler.

12. A method for the manufacture of fibreboard, substantially as hereinbefore described with reference to Fig. 1, or Fig. 1 as modified by Figs. 2 and 3, or Fig. 1 as modified by any of Figs. 4, 5 and 6.

13. Fibreboard when manufactured in an apparatus according to any of claims 1 to 8.

14. Fibreboard when manufactured by a method according to any of claims 9 to 12.

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